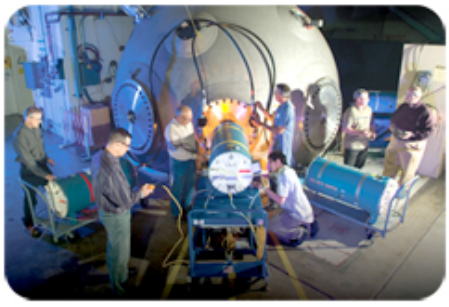
LIVERMORE LAB
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, July 18-22, 2011

C&EN | WHERE'S THE HEAF?



Scientists, engineers and technicians conduct explosive work to keep the nuclear stockpile safe and secure at the Lab's High Explosives Application Facility.

Inside an LLNL building that looks like just another office or laboratory sits the High Explosives Application Facility, where some of the nation's most dangerous chemistry is performed.

HEAF, as the facility is known, is the National Nuclear Security Administration's designated Center of Excellence for High Explosives Research & Development. Scientists use the facility to synthesize, formulate and characterize explosive materials.

Their research plays a critical role in ensuring the nations' nuclear stockpile is safe and secure by providing an understanding of how components of nuclear weapons age and perform over time.

Researchers at HEAF also develop safer explosives to replace older compounds, both for the nuclear stockpile and conventional weapons. The facility's energetic materials expertise is further brought to bear in counterterrorism activities, such as explosives detection and mitigation and modeling the effects of improvised explosive devices.

To read more, go to the Web.

Bloomberg Businessweek | SALARI SLICES THROUGH AIR

Kambiz Salari
Photo courtesy of Cody Pickens/*Bloomberg Businessweek*

The Lab's Kambiz Salari knows a thing or two about big rig trucks. Specifically, he knows that if you cut down on the aerodynamic drag they create when they are barreling down the road, the shipping industry could save $24 billion a year.

Trucks waste a lot of energy overcoming the drag created by their boxy frames. Designing sleeker big rigs, though, is harder than designing sleeker airplanes given that cargo containers can't be anything other than rectangular. Salari puts the challenge this way: "Here is a box, and you have to somehow make it more aerodynamic, but it's still a box."

Salari has spent the last decade figuring out ways to make trucks slice through the air more gracefully. An expert in the field known as computational fluid dynamics, he uses software to simulate the flow of air across a truck's exterior. Certain areas, such as the underbody or the gap between the trailer and the cab, cause a lot of resistance, but even the "grab handles" that drivers use to climb into their seats create drag. Salari's complex models take days to compute, even using Livermore's supercomputers.

He says by making relatively modest tweaks to a truck's contours, truckers could see a 17 percent efficiency gain.

To read more, go to the Web.

Inside the NIF target chamber.

Governments around the world are faced with the task of deciding on the energy source or mix of sources that are affordable and in sustainable quantities to ensure energy security.

One of those sources could be fusion energy, as demonstrated by the Lab's National Ignition Facility.

NIF is the world's largest and most energetic laser, which has the goal of achieving fusion ignition and energy gain in the laboratory for the first time. Ed Moses, director of NIF and Photon Sciences, highlighted the importance of laser technology by stating that: "Achieving ignition on NIF can be a defining moment for the world's energy future."

NIF scientists hope to achieve fusion ignition in 2012. Though fusion is considered the technology of the future, it will help the United States attain energy independence by reducing its reliance on imported oil to generate electricity.

To read more, go to the Web.

Windpower ENGINEERING & DEVELOPMENT ALL WE ARE IS WAKES IN THE WIND

Normally invisible, wind wakes take shape in the clouds behind the Horns Rev offshore wind farm west of Denmark. Photo courtesy of Vattenfall.

While wind turbines are used to produce power, they also produce wakes -- similar to what forms in bodies of water. These invisible ripples and waves and other disturbances in the atmosphere downstream can damage turbines and decrease efficiency.

Laboratory researchers and collaborators have launched a study of those wakes, with an eye toward improving the efficiency of wind farms.

Recent computer research into turbine spacing indicates about 15 rotor diameters are sufficient to dissipate wake effects and maintain the output of downwind machines. Researchers have launched a study to make the ripples visible to observe their effect on the atmosphere.

Julie Lundquist, assistant professor in the atmospheric and oceanic sciences department at University of Colorado Boulder and a former LLNL scientist, along with researchers from the National Oceanic and Atmospheric Administration (NOAA), the National Renewable Energy Laboratory (NREL), and Lawrence Livermore, are conducting the study --Turbine Wake and Inflow Case -- to improve energy production at wind farms across the country.

To read more, go to the Web.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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